at the equator (85 metres per second); while everywhere beyond latitude 35° there is a west wind which acquires its greatest velocity (379 metres per second) at the pole. In this computation a frictionless motion is considered. The distribution of the air-pressure corresponding to this has been worked out by Liebenow, and published in the *Naturwissenschaftlichen Rundschau*, Jahrgang III. p. 237, but it has no practical significance for meteorologists.

Ferrel's reasoning gives for v, the relative linear velocity of rotation, in the latitude ϕ, the following expression: —

$$v = R\,\omega \left\{ \frac{2}{3\cos\phi} - \cos\phi \right\};$$

that is, $v = 0$ for $\cos^2\phi = \frac{2}{3}$ or $\phi = 35°\ 16'$.

For $\phi > 35°\ 16'$, v is positive (west wind).

For $\phi < 35°\ 16'$, v is negative (east wind).

Ferrel's and Siemens's researches were independent of each other, but their apparently complete agreement is in reality only a partial one. They agree as to the dividing-line between the easterly and westerly air-currents (the first three being from the east, and the last four from the west); but the following little table shows how widely their computed velocities (expressed in metres per second) differ.

	Siemens.	Ferrel.
For $\phi = 0°$	85	155
" $\phi = 20°$	57	107
" $\phi = 35°\ 16'$	0	0
" $\phi = 45°$	51	110
" $\phi = 54°$	106	254
" $\phi = 70°$	220	747
" $\phi = 90°$	379	∞

In both cases there are assumed three facts: (1) The friction is not considered; (2) The initial condition is relative rest; (3) Thorough mixing of the air is accomplished by meridional motions. There are certain inaccuracies of deduction existing in both theories, so that we cannot say without qualification that one is right and the other wrong. Siemens seems to have fallen into the error of the Hadley-Dove view, that masses of air passing from one parallel to another retain unchanged their absolute velocity of rotation. It is one of the main points of Ferrel's theory, that this does not remain constant, but increases with the approach towards the axis of the earth. The following quotation from Helmholtz's memoir "Ueber Atmosphärische Bewegungen" (*Meteorologische Zeitschrift*, 1888, p. 329) shows his complete agreement with Ferrel. He says, "If we consider a rotating belt of air, whose axis coincides with the axis of the earth, and which is pushed first a little to the north and then a little to the south by the pressure of the adjoining similar belt, then, if the friction is not considered, according to the well-known general mechanical principle, the moment of rotation must remain constant." This can be true only when the angular velocity of the belt changes in an inverse proportion to the square of its radius. The two velocities at the poles obtained by Ferrel and Siemens, and given in the table, are both far removed from the true value; but in either case there would be a crowding-back of the air from the axis of rotation, because such great velocities of rotation are impossible. Ferrel, however, in his further development, so limits the theoretical conditions that these impossible velocities are modified into possible conditions. It is quite amusing that some readers of Ferrel's writings have understood him to make the ridiculous statement that all of the results found by his purely theoretical deductions do actually exist in nature; and they claim that such absurdities are sufficient to cause his theory to be rejected. It merely shows that such persons have only glanced at Ferrel's writings.

(*a*) The resistances to motion, such as friction and the like, make it impossible that such a great increase as Ferrel and Siemens figure out can occur in the relative motions of the air; and Helmholtz has given his views of this action, in the paper previously mentioned.

(*b*) Again: the mixing-up of the air does not occur in the assumed uniform manner which requires that all the air, no matter what its altitude is, which proceeds from about the latitude of 35°, reaches all other latitudes. As an actual fact, we find that the motion toward the pole, towards gradually narrowing circles of latitude, takes place mostly in the higher layers of the atmosphere, and the opposite motion in the lower layers. According, then, to the law of the conservation of areas, we owe to the upper movements the west wind, and to the lower the east wind.

The modifications of this simple scheme which are necessary to account for the observed wind phenomena are next discussed by Dr. Sprung, who gives special attention to the recently expressed views of Dr. Peruter (see *Wetter*, p. 11, 1890; also given in a lecture at Vienna, Nov. 7, 1889), concerning the lack of an upper south-west trade-wind between the two parallels of 35° latitude; his view being based on the theories of Siemens and Oberbeck, and in opposition to that of Ferrel. Professor Abbe's recent studies of cloud-motions in the tropics will be very useful in this connection. The tendency towards the origination of a tropical east wind is far more marked in the theory of Ferrel than in that of Siemens. That the actual wind circulation as marked out by these two investigators are so contradictory seems to be due to the fact that Siemens simply combined with the weak meridional surface currents the results obtained in (9), without considering that this is sensibly changed by the conditions explained under (6). Ferrel, on the contrary, carefully investigated the gradients of air pressure, and found that the east wind of the tropics could be perceived to only a limited extent.

Sprung's trite references to the recent works of Oberbeck (*Sitzungsberichte Berlin Akademie*, March 5 and Nov. 8, 1888) and Möller (*Archiv der Seewarte*, vol. 10), and his own attempt to treat this question of the upper anti-trades in an empirical manner, cannot be discussed in the present short communication. The last section (five pages) of Sprung's paper is of special importance to the student of this question of general motions, for he treats analytically the reasons for the use of the principles adopted in Siemens's paper.

FRANK WALDO.

Mount Lake Park, Md., July 29.

A Brilliant Meteor.

ON Sunday night, July 27, at 11.15 P.M., while sitting on the piazza looking west, I saw a remarkable meteor, which in size and slowness of movement resembled that of 1861 (which I also saw).

It appeared from beneath the edge of one of the fleecy streaks of cloud with which the sky was full, about forty degrees above the horizon. Its path was downward, very slightly southward. When it first appeared, it rapidly increased in size to a large sphere of brilliant white light, changing immediately to a pale apple-green as it descended, followed by a train of dark-red glowing particles. Its duration above the horizon was about two seconds.

The clouds were not thick enough to obscure the light of third-magnitude stars.

F.

Sea Girt, N.J., July 30.

BOOK-REVIEWS.

Hypnotism. By ALBERT MOLL (of Berlin). (Contemporary Science Series.) New York, Scribner & Welford. 8°.

HAVING noticed the general plan and scope of this work upon the appearance of the original German edition (*Science*, July 19, 1889), it may suffice to express briefly our appreciation of the value of this contribution to the English literature on hypnotism. We have had a translation of Bernheim's important work, and of Krafft-Ebbing's treatise on the subject from the more strictly medical point of view, and translations of Binet and Féré, and of Björnström, giving more general expositions of hypnotic phenomena. It is with the latter class of works that Dr. Moll's invites comparison. It is much fuller and more thorough than Björn-